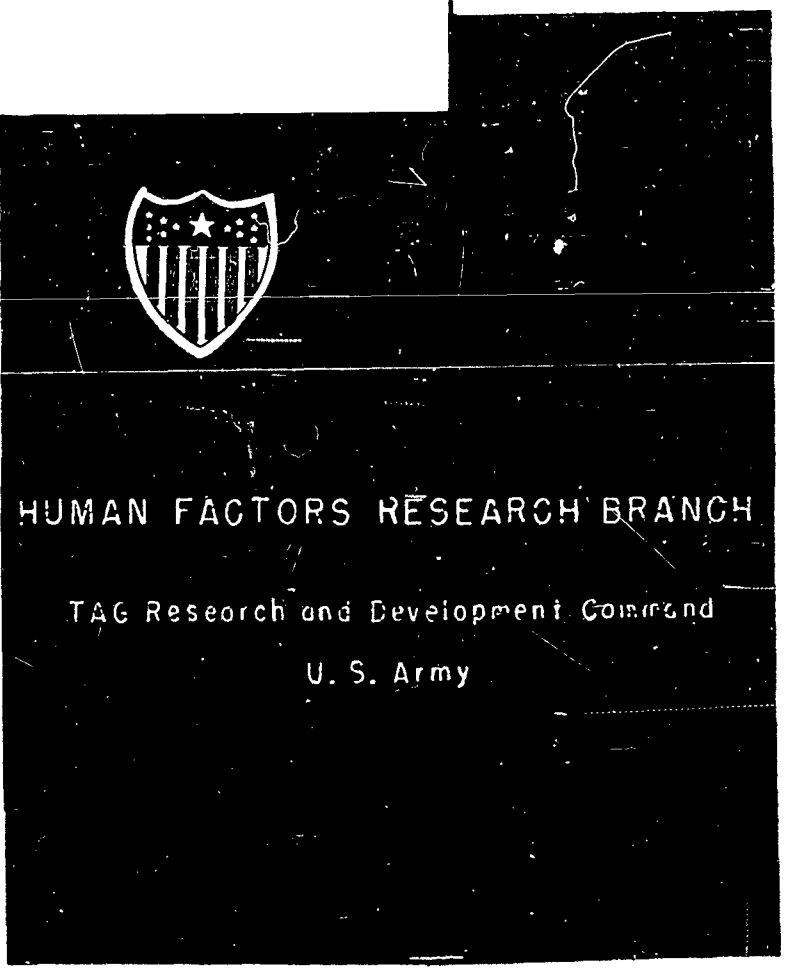
TECHNICAL RESEARCH NOTE 115

DEVELOPMENT OF EXPERIMENTAL SELECTORS FOR ARMY HELICOPTER PILOT TRAINEES--PERSONALITY CONSTRUCTS



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DEVELOPME EXPERIMENTAL SELECTORS FOR ARMY HELICOPTE TRAINEES--PERSONALITY CONSTRUCTS

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PREFACE

Technical Research Note 115 describes the fifth in a series of studies leading to identification of improved predictor measures for use in the selection of Army helicopter pilot trainees. Early publications in the series (Technical Research Notes 93, 99, and 101) reported research to identify a large number of potentially useful predictors. Technical Research Note 104, "Development of a provisional battery for selecting Army helicopter pilot trainees," describes the application of test selection procedures to experimental predictor measures and discusses management and research considerations leading to the recommendation in 1959 of a battery of six tests for operational use pending results of more definitive validation studies. Criteria for the additional research include evaluations both of training performance and post-training performance as helicopter pilots.

The present report is one of several dealing with the development of a personality measure, or measures, designed primarily to predict leadership performance in operational units. The development of construct predictors and their validation against various aspects of helicopter pilot training performance is described. Later publications will describe the development of predictors based on item analysis of the preliminary instruments. A final report will summarize validity studies leading to the recommendation of an operational selection battery.

BRIEF

DEVELOPMENT OF EXPERIMENTAL SELECTORS FOR ARMY HELI COPTER PILOT TRAINEES--PERSONALITY CONSTRUCTS

Requirement:

This study was part of a long-range research effort to improve selection of helicopter pilot trainees so as to reduce attrition rate during training. The specific objective of the present study was to develop material for inclusion in one or more personality measures which would be subjected to further validation as part of an experimental selection battery.

Procedure:

A number of scores based on selected items in four newly prepared personality instruments were tried out for effectiveness in predicting several aspects of helicopter pilot trainee success, with emphasis on preflight leadership training and rankings by fellow trainees and tactical officers. Since the leadership rankings were obtained late in the training cycle, they were considered nearly equivalent to evaluations of the overall job performance of warrant officer pilots. Data were obtained on 242 helicopter pilot trainees constituting six entering classes of the Army Primary Helicopter School.

Results:

A score based on items judged relevant to preflight training was found to have promising validity ($r = .39$). Of the other 57 measures, designed to provide scores on rather strictly delineated aspects of personality, 15 were predictive of preflight training success, four of leadership rankings.

Utilization of Findings:

The four personality instruments constituted a large pool of items from which an instrument was developed for operational use on the basis of item analysis. Results of the present study were useful in identifying the most promising predictor content for the additional analysis.

DEVELOPMENT OF EXPERIMENTAL SELECTORS FOR ARMY HELICOPTER PILOT TRAINEES--PERSONALITY CONSTRUCTS

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BACKGROUND

The Human Factors Research Branch has in progress a research program to provide improved measures for use in selecting helicopter pilot trainees. The research effort was initiated in response to an urgent need to reduce the high attrition rate at the United States Army Primary Helicopter School, a rate which in recent years has run about 50 percent. In view of the length of the training period (currently 34 weeks), and the high cost of maintaining and flying helicopters, staff agencies of the Department of the Army urged the introduction of selection measures which gave promise of even moderate improvement in selection. Accordingly, the Human Factors Research Branch has recommended several interim selection batteries for operational use as partial results of prediction research have become available.

Since the beginning of 1957, helicopter pilot training has been given in three phases: 4 weeks of preflight training, 16 weeks of primary flight training, and 14 weeks of advanced flight training. Enlisted men who successfully complete the full training program become Warrant Officers. Early experience in operational units with the pilots who had graduated from the Army helicopter school revealed that some of the graduates lacked the leadership qualities necessary for their nonflying duties. The preflight training phase was introduced to provide leadership training of the type given in Officer Candidate School. The first interim selection battery, made operational in May 1955, contained two leadership predictors: a supervisory rating (the Officer Candidate Evaluation Report OCE-2) and a board interview (Officer Candidate Interview OCI-4, available from the Officer Candidate selection program of the Branch).

Since competence in leadership was so important for enlisted graduates of the helicopter training program, four new personality questionnaires, containing a total of 698 items, were constructed for tryout. The new instruments were designed to extend item coverage beyond that of existing MMPI-type self-description instruments to include attitudes and interests, as well as personal and family background. Items were written around a large number of constructs, conceived as generally important variables on which individuals may be expected to differ. The items constituted the operational definition of each construct. No particular effort was made to develop constructs solely on the basis of relationship to successful completion of helicopter pilot training. One construct, for example, was physical activeness, delineated by twenty items dealing with specific aspects of the construct--a liking for activities requiring rapid and sustained movement, being on the go, stamina, and continuous action, as opposed to desire for rest, leisure, relaxation, and avoidance of excitement and tension. Another was liking for order, defined as meticulousness in attitude or behavior as opposed to carelessness.

PURPOSE

The present study was undertaken to evaluate the usefulness of the construct approach and of the constructs incorporated in the four new personality instruments as a means of developing personality measures for the helicopter pilot selection battery.

Specifically, the effectiveness of 57 construct keys and of one overall judgment key as predictors of helicopter pilot training success was to be estimated.

To gain a more analytic knowledge of the nature of pilot training success, the validity of the numerous construct keys was assessed against various aspects of pilot training. Of these aspects, successful completion of preflight training and leadership rankings by peers were considered most predictable by the personality measures.

METHOD

POPULATION AND SAMPLES

The population was defined as all enlisted applicants for the U. S. Army Primary Helicopter School who meet standards qualifying them for consideration. Applicants are considered for admission if they are between 20 and 30 years old, have a score of 110 or higher on the General Technical (GT) Aptitude Area of the Army Classification Battery, meet Class I medical standards for flying, and have fulfilled certain other administrative requirements.

The samples for the validation studies reported here, however, consisted of trainees (and graduates) who had undergone further selection on the basis of their relative standing on an interim operational battery of which the Officer Candidate Interview Board procedures constituted one hurdle.

The total sample consisted of members of classes 57-1 through 57-4, and classes 57-6 and 57-7. The first class began the 34-week training course in July 1956, the last class in January 1957. The first four classes were trained at Camp Rucker, Alabama, the last two at Camp Wolters, Texas after transfer of the USAPHS to the latter location. Training at the two locations differed slightly in organization and procedures. Flight training at Camp Wolters, for example, was conducted by civilian instructors rather than by military officers. The schedule was rearranged after the move to Camp Wolters so that the period covered by the peer rankings differed by one to three weeks from that at Camp Rucker. At Camp Rucker, only fellow trainees participated in the rankings. At Camp Wolters, rankings were also obtained from tactical officers. These changes in the criterion measure during data collection are not believed to have altered results appreciably.

The following three subsamples were used in the present analyses:

Preflight training sample. Trainees who passed the preflight training phase versus those who failed for any reason other than medical or administrative reasons. Medical and administrative failures during preflight training were omitted from analysis. N = 253.

Flight training sample. Trainees who passed flight training versus those who failed by reason of flying deficiency, or by reason of flying deficiency plus other reasons. Medical and administrative drop-outs from Phase II were also eliminated from analysis. N = 192.

Graduates. Those of the initial sample who successfully completed training constituted the sample for analysis of predictors in relation to leadership rankings and for additional analysis in terms of total flight performance and final academic grade. N = 152.

CRITERION MEASURES

Pass-fail preflight training. Preflight training is a separate four-week phase of training designed to weed out leadership failures prior to flight training. Attrition during the early phase was generally attributed to deficiencies in leadership ability, conduct, attitudes, and motivation.

Leadership ranking. For the first four classes, which completed training at Fort Rucker, Alabama, leadership rankings were obtained at the end of 21 weeks of training. Peer rankings assigned each trainee by a group of his peers were averaged. Average rankings were equated for size of rating group and converted to percentile scores.

For the last two classes, trained at Camp Wolters, Texas, peer rankings were obtained at the end of 18 weeks of training, and tactical officer rankings were obtained at the end of 20 weeks. Average peer rankings and average tactical officer rankings were converted separately to percentile scores and then combined, peer rankings being double weighted. The procedure was carried out separately for each class. Scores from class to class (including the four Camp Rucker classes) were arbitrarily defined as equivalent. Data from Camp Wolters was then combined with data from Camp Rucker.

Each student rater was instructed to rank all members of his platoon except himself, considering and evaluating the candidate as to force, attitude, and dependability, but not limiting himself to consideration of those traits alone. A tactical officer ranked all students in his platoon on Warrant Officer Candidate potential.

Four additional criterion measures were obtained:

Percentage of presolo flights rated satisfactory. Most attrition due to flying deficiency occurs in the presolo flight phase of training. Each flight is graded satisfactory, unsatisfactory, or dangerous. The variable analyzed was the percentage of presolo flights graded satisfactory.

Pass-fail flight training. A dichotomous measure denoting successful completion of flight training versus failure for flying deficiency reasons or for multiple reasons including flying deficiency.

Final practical flight grade. For each student who graduated, the instructor reviewed the entire flight record and assigned a numerical grade of 70 to 100.

Final academic grade. A percentage grade of 70 to 100 based on classroom performance. Academic training covered various aspects of helicopter flying and maintenance.

PREDICTOR VARIABLES

Predictors were 57 constructs plus one overall judgment key, based on 698 items assembled in the four newly constructed instruments listed below. Brief descriptions of the instruments and the constructs incorporated in each instrument are presented in Appendix A.

Instrument	Number of items	Number of constructs
Activities Inventory (PT 3145)	215	11 constructs 1 judgment key
Helicopter Pilot Trainee Attitude Questionnaire (PT 3147)	74	3 constructs
Personal Description Inventory (PT 3159)	198	11 constructs
Personal History Form (PT 3161)	211	32 constructs

REFERENCE VARIABLES

A complete list of the reference variables considered in the evaluation of the personality constructs is presented in Appendix B. They included:

Tests of the Army Classification Battery.

The interim operational battery used in selection of helicopter pilot trainees, including the Officer Candidate Evaluation Report, OCE, and the Officer Candidate Interview, OCI.

Experimental predictors of helicopter pilot performance including psychomotor tests, experimental aptitude tests, and personality measures now in process of development.

STATISTICAL ANALYSES

Validity of the constructs was estimated by correlating scores on each construct key with scores on each criterion fraction. In the case of the dichotomous criterion variables, pass-fail preflight training and pass-fail flight training, biserial correlation coefficients were computed[1/]. Product moment coefficients were computed against peer leadership rankings, as well as against the three other criterion fractions. No correction for restriction in range was made for any of the validity coefficients reported. In previous studies, correction for explicit restriction in range on the basis of the interim operational battery had resulted in small change in validity coefficients obtained.

Since the purpose of the analyses was to select promising predictors for continuing validation studies, evaluation of the constructs was in part qualitative. For constructs in three of the instruments, a coefficient significantly different from zero at the .05 level was considered indicative of promise. Because of the variation of key length characterizing the constructs of the Personal History Form (1 to 30 items, with a median key length of 7 items), a higher level of significance (.01) was established as a requirement for further consideration of Personal History Form constructs.

A benchmark of useful validity was the correlation with the several criteria attained by the reference variables, including several personality tests for which indications of validity for the present purpose had been found in earlier studies.

1/Soper's formula, as given by Kelley, T. L., in Fundamentals of Statistics (Formula 10:79, page 256) was used to compute the significance of the biserial correlation coefficients.

RESULTS

Of the 57 constructs evaluated, 15 were found to correlate significantly with the preflight training criterion, four with the leadership rankings. One construct, social manipulative, was significantly related to both criteria--at the .05 level, however.

PREDICTION OF PREFLIGHT TRAINING SUCCESS

Seven of the constructs predictive of preflight training success were based on items in the Activities Inventory: physical activeness, affiliation, responsibility, ambition, social manipulative, thrill and adventure seeking, and nurturance (Table 1). One of the three keys of the Helicopter Pilot Trainee Attitude Questionnaire attained significant validity--Army life attitude (Table 2). The other two attitude keys, Warrant Officer aspiration and flying attitude, were not related to the criterion. In the Personal Description Inventory, keys for the self-confidence, distractibility and indecisiveness, and activity level constructs yielded correlation coefficients significantly different from zero (Table 3).

Four of the 32 construct keys incorporated in the Personal History Form were found to be related to the preflight training criterion: membership in clubs and organizations, individual noncooperative sports participation, breadth of social skills, and high socio-economic status. For the latter construct (represented by such items as family ownership of car, family had savings account) the biserial correlation coefficient was -.27, indicating that high socio-economic status was associated with failure in preflight training. The fact that the converse, low socio-economic status, was not significantly related to the criterion called into question the predictive value of the high status construct (Table 4).

A favorable augury for development of a personality measure to predict pass-fail preflight training was the validity coefficient (r_{bis} = .39) attained with the a priori judgment key of the Activities Inventory which included items from 11 constructs. The items contained in the Activities Inventory--and indeed in all four newly constructed instruments--while written with specific constructs in mind, also formed a pool appropriate for item analysis, the next step in predictor development.

Table 1

VALIDITY COEFFICIENTS OF CONSTRUCT KEYS OF THE ACTIVITIES INVENTORY FOR HELICOPTER SCHOOL CRITERION FRACTIONS

Var. No.[a]	Variable	M N = 253	SD N = 253	Pass-Fail Preflight[b] N = 253	Leadership Ranking N = 152	Pass-Fail Flight[c] N = 192	Percent Satisf. Flights N = 192	Final Flight Grade N = 152	Final Acad. Grade N = 152
29	Masculine Toughness	8.7	3.9	.12	.07	-.02	.03	-.01	.05
30	Liking for Order	14.3	2.9	.00	-.08	-.06	.01	.17*	-.04
31	Physical Activeness	12.7	2.9	.27**	-.13	-.06	-.01	-.01	-.03
32	Independence	11.3	2.4	.06	-.13	-.19	-.04	.07	.06
33	Affiliation	13.1	3.0	.28**	-.04	-.11	-.09	.02	-.12
34	Responsibility	16.6	2.3	.23**	-.03	-.06	-.03	.00	-.04
35	Social Manipulative	11.7	4.0	.19*	-.16*	-.01	.00	.03	-.06
36	Thrill and Adventure	13.4	3.7	.20*	-.12	-.21*	-.11	.00	-.04
37	Nurturance	15.9	2.2	.19*	.02	-.03	.04	.15	-.14
38	Ambition	14.5	2.4	.28**	-.11	-.14	-.04	.05	.03
39	Practical Orientation	14.3	2.3	.02	.19*	.17	.07	-.06	.15
40	Overall Judgment Key	88.5	9.4	.39**	-.08	-.10	-.05	.01	-.00

[a] Variables are defined in Appendix A.

[b] Percentage passing = 81.4

[c] Percentage passing = 80.7

* Significant at the .05 level

** Significant at the .01 level

Table 2

VALIDITY COEFFICIENTS OF CONSTRUCT KEYS OF THE HELICOPTER PILOT TRAINEE ATTITUDE QUESTIONNAIRE FOR HELICOPTER SCHOOL CRITERION FRACTIONS

Var. No.[a]	Variable	M N = 253	SD N = 253	Pass-Fail Preflight N = 253	Leadership Ranking N = 152	Pass-Fail Flight N = 192	Percent Satisf. Flights N = 192	Final Flight Grade N = 152	Final Acad. Grade N = 152
41	Army Life Attitude	28.4	3.1	.17*	.06	.03	.08	.14	-.02
42	Warrant Officer Aspiration	6.7	1.4	-.03	.04	.20*	-.01	-.03	.05
43	Flying Attitude	11.1	1.7	.16	-.20*	-.05	-.07	-.02	-.10

[a]Variables are defined in Appendix A.

*Significant at .05 level

Table 3

VALIDITY COEFFICIENTS OF CONSTRUCT KEYS OF THE PERSONAL DESCRIPTION INVENTORY FOR HELICOPTER SCHOOL CRITERION FRACTIONS

Var. No.[a]	Variable	M N = 253	SD N = 253	Pass-Fail Preflight N = 253	Leadership Ranking N = 152	Pass-Fail Flight N = 192	Percent Satisf. Flights N = 192	Final Flight Grade N = 152	Final Acad. Grade N = 152
44	Activity Level	18.7	2.7	.19*	.05	-.05	-.01	.09	.02
45	Self-Confidence	15.8	2.6	.23**	.02	.11	.02	.03	.13
46	Distractibility	16.1	2.9	.26**	.12	.06	-.01	-.04	.15
47	Masculine Personality	17.3	2.1	.07	.09	.02	.02	-.05	.02
48	Self-Reliant	12.8	2.5	-.09	.02	.09	-.02	-.14	.08
49	Social-Interpers. Relations	17.8	2.7	.15	.01	.14	.05	.06	.08
50	Social Responsibility	21.6	2.5	.14	.06	.00	-.02	.13	.04
51	Sociability	5.5	3.4	.04	-.03	-.12	-.06	.11	-.07
52	Responsibility	13.4	2.9	.05	-.01	.18	.01	-.11	-.04
53	Emotional Stability	10.2	3.1	.09	.08	.05	.04	-.14	.16*
54	Ascendancy	6.7	2.6	.01	.01	-.13	.00	.19*	-.03

[a]Variables are defined in Appendix A.
*Significant at .05 level
**Significant at .01 level

Table 4

VALIDITY COEFFICIENTS OF CONSTRUCT KEYS OF THE PERSONAL HISTORY FORM FOR HELICOPTER SCHOOL CRITERION FRACTIONS

Var. No.[a]	Variable	M N = 253	SD N = 253	Pass-Fail Preflight N = 253	Leadership Ranking N = 152	Pass-Fail Flight N = 192	Percent Satisf. Flights N = 192	Final Flight Grade N = 152	Final Acad. Grade N = 152
55	Disturb Cond-Neg	0.9	1.1	.01	-.00	-.16	-.13	-.05	.01
56	High Socio Ec-Pos	2.3	1.4	-.27**	.03	-.03	-.05	.10	-.12
57	Low Socio Ec-Neg	4.1	2.1	.08	.00	.16	.08	-.09	.16*
58	Educ	2.4	0.8	-.02	-.06	-.03	-.05	-.06	-.07
59	Parental Ed	4.7	1.6	.15	-.11	-.14	-.03	.02	-.08
60	HS Jobs-Pos	2.3	1.8	.05	.04	-.20*	-.20**	-.02	.04
61	HS Jobs-Neg	0.2	0.5	.02	-.00	.04	.10	.16*	-.02
62	Nutrition-Neg	1.2	1.5	-.16	-.05	.00	-.02	.04	-.17*
63	Phys Injuries	2.2	2.1	.18*	.01	.05	.02	-.06	-.05
64	Psychosomatic	0.8	1.2	-.02	.05	-.11	-.03	.02	.06
65	Hospitalization	0.4	0.8	-.06	-.02	.05	-.08	-.21**	.13
66	Rec and Ed-Oppor	4.8	3.2	.16	-.05	.15	.08	.04	-.06
67	Rec and Ed-Soc	1.4	1.4	.09	-.08	.14	.00	.02	.00
68	Rec and Ed-Indiv	1.0	1.2	.06	-.14	.15	.05	.05	-.04
69	Gp Membership	3.4	3.1	.24**	-.08	-.12	-.08	.06	-.09
70	Gp Leadership	0.6	0.9	.18*	.03	-.00	.02	.08	-.22**
71	Sports-Indiv	9.0	3.9	.36**	.01	.01	-.04	.02	-.16*
72	Sports-Team	4.5	2.4	.21*	.07	.01	.02	.01	-.17*
73	Science Trg	3.8	2.7	.14	.11	.07	-.02	-.02	-.08
74	Indus Trg	1.9	1.7	.06	-.06	.13	.07	.09	-.03
75	Coml Trg	2.2	1.8	-.03	-.05	.12	.10	.10	.10
76	Humanities	6.5	3.2	.17*	-.17*	-.13	-.17*	-.07	-.12
77	Mil Trg	0.3	0.8	.06	-.09	-.15	-.12	.16*	-.02
78	Religious Trg	0.4	0.9	.18*	-.09	-.36**	-.24**	.03	-.05
79	Teen-age Soc Activ	3.5	1.4	.20*	.07	.12	.13	.08	-.11
80	Lit-Artistic	1.0	1.1	.02	-.14	-.09	-.14*	-.19*	.02
81	Mus Interest	0.4	0.8	-.05	-.28**	-.04	.01	.01	.07
82	Hobbies-Indiv	0.6	1.0	-.08	-.08	-.04	-.04	.07	-.04
83	Breadth of Soc Skills	10.1	4.4	.30**	.06	.03	.00	-.06	-.08
84	Tools-Farm	1.6	2.3	-.13	.01	.11	.08	.08	.01
85	Mech Constr	7.4	3.3	.12	.04	.12	.15*	.14	-.25**
86	Use of Guns	1.6	1.2	-.06	.02	.18	.10	.02	-.01

[a]Variables are defined in Appendix A.
*Significant at .05 level
**Significant at .01 level

PREDICTION OF LEADERSHIP RANKINGS

Considerably less success was attained with construct keys in predicting the leadership criterion (Tables 1 through 4). Only four constructs were significantly related to the peer and tactical officer rankings: social manipulative (in the negative direction) and practical orientation from the Activities Inventory; flying attitude from the Attitude Questionnaire; and musical interest ($r = -.28$) from the Personal History Form. Further, the Activities Inventory judgment key, which was found to be a promising predictor of the preflight training criterion, correlated -.08 with the leadership rankings.

Results obtained with reference variables in the present analysis--and in previous studies of the series as well--indicated that the peer ranking measure is exceedingly difficult to predict. Of the reference variables included in the present analysis, only the Officer Candidate Evaluation Report, and the Interim Operational Battery of which OCE is a component, were significantly related to the peer rankings. The failure of all other reference variables to correlate significantly with the leadership measure indicated that this criterion is virtually independent of the variance in typical cognitive tests. In an earlier study, the General Information Test score was among the limited number of valid predictors of peer rankings. (The others were enlisted grade and a psychiatric rating based on an interview.) The General Information Test, however, was designed to measure interests rather than general knowledge per se.

A possible explanation of the failure of the peer leadership criterion to generate larger validity coefficients is the fact that the range of competence represented in the sample was considerably restricted. Ratings could be obtained only for graduates of the entire flight training program, since by the 18th or 21st week of training (when ratings were obtained) practically all attrition from the classes had already occurred. This selection is in addition to restriction incurred in selection for the flight training program itself. The presumption is reasonable that the restriction-in-range factor is partially responsible for the relatively low validity evidenced in the present analysis.

A second reservation concerning the conclusions to be drawn from the generally low correlation of constructs with the leadership criterion measure stems from the varying number of items representing the constructs, particularly the 32 constructs of the Personal History Form. In that instrument, variability in key length (a range of 1 to 30 items), greater than in the case of the other three instruments, made interpretation of results somewhat difficult. Considering all criterion fractions, 10 constructs of the Personal History Form yielded validity coefficients significantly different from zero (.01 level). For the valid constructs the median key length was 13 items, in comparison with a median of 7 items for all 32 constructs. Key length therefore appeared to be associated with validity, and the constructs represented by relatively few items may not have been given a fair chance to show validity as compared with keys of greater length.

In general, based on the results of the present study, constructs appear not to offer an effective approach to the prediction of peer leadership rankings. At the same time, usefulness of personality constructs should not be completely discounted, first, in view of the twice restricted nature of the sample, and second, in view of the variation in the length of keys representing the various constructs of the Personal History Form.

OTHER CRITERION FRACTIONS

A few constructs were significantly related to the remaining four criterion measures: with flight training success, thrill and adventure seeking ($r = -.21$), Warrant Officer aspiration ($r = .20$), and school subjects--religious training; with percentage of presolo flights rated satisfactory, degree of enterprise (represented by high school job experience) and school subjects--religious training; with total flight evaluation, recreation and educational equipment (that is, opportunity to use such equipment in the home), and school subjects--military training. Two constructs, clubs and organizations--group leadership, and team sports activity were predictive of final academic grade.

The general conclusion was that the additional criterion measures were relatively independent of the variance associated with the construct keys.

CONCLUSIONS

Results from the present analysis reinforced previous indications that personality measures are promising predictors of Army helicopter pilot training success, particularly of the motivational and leadership aspects of the criterion. The degree of validity shown by the judgment key of the Activities Inventory for pass-fail preflight training indicated that an eclectic key covering a broader sampling of behavior had some advantage over the strictly limited conceptualizations of the construct keys.

While the constructs here evaluated were not usefully predictive of the leadership evaluations, the restricted nature of the sample and variation in the number of items in the construct keys precluded definitive conclusions.

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APPENDIXES

APPENDIX A

DESCRIPTION OF THE EXPERIMENTAL PERSONALITY MEASURES AND CONSTRUCT KEYS

Four personality measures were administered. From each of these a number of personality measures based on constructs were derived. These variables are identified and described below.

Activities Inventory, PT 3145

This instrument consists of 215 items allocated to mutually exclusive construct keys. A judgment key was also set up, based on the first 121 items of the test. Judges rated each item as to which response was indicative of success in the helicopter program. Items from all constructs were included.

29. Masculine Toughness vs Harm Avoidance. Items expressive of liking for rough, tough, rugged and possibly dangerous activities, as opposed to self-indulgence, protection of self from harm, liking for ease and comfort. (21 items. TX 314)

30. Liking for Order, Neatness and System. Liking for being orderly, systematic, meticulous, and even pedantic or compulsive as opposed to liking for flexibility, change, variety, spontaneity, taking things as they come, minimizing planning. (22 items. TX 315)

31. Physical Activeness. Liking for activities requiring rapid and sustained movement, being on the go, stamina and continuous action, as opposed to desire for rest, leisure, relaxation, and avoidance of excitement and tension. (20 items. TX 316)

32. Independence, Self-reliance and Confidence. Liking for being independent, autonomous; willingness to expose self to possible ridicule or censure, as opposed to desire for receiving aid, assistance, succorance, sympathy; avoidance of blame, playing it safe. (18 items. TX 317)

33. Affiliation and Sociability. Liking to affiliate, be a member of a group, engage in activities with others, as opposed to avoiding others, being solitary, living, working, and playing alone, etc. (17 items. TX 318)

34. Responsibility, Will-determination and Persistence. Liking for and seeking responsibility; motivated by inner standards, persisting in the face of difficulties, etc., as opposed to playful and fun-loving, irresponsible and non-perservering. (19 items. TX 319)

35. Social Manipulative. Liking for manipulating or controlling others, power seeking, setting self as surrogate of group standards and morals, selling, coercing, convincing, etc. (21 items. TX 320)

36. Thrill and Adventure Seeking. Liking for the thrilling and adventurous, being where things are going on, going places and doing things; responsive to stimulating and dramatic events, change of pace, variety of experience, the unusual, bizarre and different. (22 items. TX 321)

37. Nurturance. Liking for nurturing others by assisting, abetting, sympathizing, facilitating, etc., as opposed to being disruptive, discouraging, interfering, annoying, squelching, humiliating, etc. (19 items. TX 322)

38. Ambition, Striving, Motivated. Liking for competition, goal seeking, striving to win, proving superiority, achieving difficult goals, gaining recognition and status through achievement. (18 items. TX 323)

39. Practical Orientation. Liking for the practical, tangible, clearly denoted, socially and monetarily rewarding, etc., as opposed to the obscure, theoretical, aesthetic or philosophical. (18 items. TX 324)

40. Judgment Key. Judges rated the first 121 items of the test as to which response would be indicative of success in the helicopter program. (121 items. TX 325)

Helicopter Pilot Trainee Attitude Questionnaire, (PT 3147)

This instrument consists of 74 attitude items, 62 of which are classified into three mutually exclusive construct keys.

41. Army-Life Attitude. Items reflect attitude toward the Army, its leadership, its role in national defense, etc. (38 items. TX 337)

42. Warrant Officer Aspiration. Items reflect attitude toward increased rank and responsibility. (9 items. TX 338)

43. Flying Attitude. Items reflect attitude specifically related to the flight portion of military aviation. (15 items. TX 339)

Personal Description Inventory, (PT 3159)

This instrument consists of 198 items, 162 of which are self-descriptive (Part I), and 35 of which are two-choice forced-choice items (Part II). The items in Part I comprise variables 46 through 52 and are mutually exclusive, that is, each item is scored for only one key. In Part II, however, each of two parts to a forced-choice item is categorized in a different construct. For example, Item 163 requires the examinee to choose the best description of himself from:

A) I am socially a good mixer
B) I am thorough in all my work

The A response is scored for Sociability, the B response for responsibility. In interpreting results for the constructs of Part II, the interdependence of the constructs due to item overlap was taken into consideration.

44. Activity Level. This construct deals with the "pace of life" and eagerness for new experiences. Persons with high activity level are never complacent and will not get into a rut. They are impatient and restless when inactive. They don't seek sedentary outlets. They are gregarious, quick in stride, and get a "boost" out of life. (24 items. TX 326)

45. Self-Confidence. Self-evaluation of worthwhileness, particularly in terms of effectiveness with groups and leadership ability. The individual who is not shy, who believes he is good at various activities, and who will speak up for his beliefs scores high in this trait. (21 items. TX 327)

46. Distractibility and Indecisiveness. Distractible and indecisive people have difficulty concentrating. They can be distracted by any activity which enables them to avoid facing a problem squarely. It is painful for them to make decisions. They worry about decisions they have made. (22 items. TX 328)

47. Masculine Personality. A man high on this construct will like the challenge of flying. He will be rated above average by peers. These are "outdoor men"; they're not offended by off-color stories, not afraid to get their hands dirty; they are in good condition and like to keep that way. They like contact sports, are not afraid of getting bruised. While not necessarily sloppy, they are not likely to shave on a day off. They like robust food. They can do things with their hands. Clothes are of little interest. (26 items. TX 329)

48. Self-Reliant, Independent. This construct has as its core the extent to which people seek guidance from others and need the company of other people. They can't or won't work alone. The "do-it-yourself" man is high in this area. (22 items. TX 330)

49. Social-Interpersonal Relations. The person high in this area maintains good relationships with peers in the job situation and is, to a moderate extent, socially oriented. He does not avoid social interaction with others, on or off the job. He conducts himself well at social activities. The person low in this area is likely to be abrupt with others, deprecating, and self-centered. He does not actively seek out others, possibly because of his lack of acceptability. (22 items. TX 331)

50. Social Responsibility. Persons scoring high in this area tend to have a built-in "self-starter" and a fairly strong super-ego. In a given situation they perceive their responsibilities and proceed to take necessary action. They accept regulations and rules and abide by them without much objection. (25 items. TX 332)

51. Sociability. 18 response alternatives keyed. (TX 333)

52. Responsibility. 18 response alternatives keyed. (TX 334)

53. Emotional Stability. 18 response alternatives keyed. (TX 335)

54. Ascendancy. 18 response alternatives keyed. (TX 336)

Personal History Form, (PT 3161)

This 211-item background inventory contains 32 construct keys which vary in terms of the number of items, and the number of responses which are scored for the items. The questionnaire itself consists of Part I (items 1-18) which deals with family structure, unusual family circumstances, financial status, education, and father's occupation. Part II deals with high school jobs performed (items 19-27), geographical areas of the country lived in (items 28-34), size of community lived in (items 35-39), foods served at home and food preferences (items 40-59), childhood and adolescent diseases and injuries (items 60-85), family ownership and own use of recreational or hobby equipment (items 86-105), membership in various clubs and organizations (items 106-117), participation in sports (items 118-137), school subjects studied (items 138-158), entertainment activities such as attending movies or playing cards (items 159-188), and skill with various tools and implements (items 189-211).

55. Disturbing Conditions--Negative. Only child in family, father of advanced age at birth of subject, parents divorced, etc. (6 items. TX 282)

56. High Socio-Economic Status--Positive. Family had car, had savings account, life insurance, etc. (8 items. TX 283)

57. Low Socio-Economic Status--Negative. Family did not have car, did not have savings account, life insurance, etc. (6 items. TX 284)

58. Educational Achievement. Educational achievement by age 18. (1 item. TX 285)

59. Parental Education. Education of mother and of father. (2 items. TX 286)

60. High School Jobs--Positive (Degree of Enterprise). Working at jobs other than full-time during high school. (9 items. TX 287)

61. High School Jobs--Negative (Economic Hardship). Working at jobs full-time during high school. (9 items. TX 288)

62. Nutrition--Negative. Dislike of, and refusal to eat foods served in the home. (20 items. TX 289)

63. Health--Positive (Physical Injuries). Having had broken bones, cuts requiring stitches, or sprains. (10 items. TX 290)

64. Health--Psychosomatic Diseases. Having had such conditions as acne, allergic rash, sties, etc. (12 items. TX 291)

65. Health--Withdrawal from Normal Environment. Hospitalization because of various diseases or injuries. (26 items. TX 292)

66. Recreational and Educational Equipment--Opportunity. Ownership by family and permission to use such items as archery equipment, classical record collection, typewriters, etc. (20 items. TX 293)

67. Recreational and Educational Equipment--Socializing Conditions. Ownership by family and frequent use of badminton set, billiard table, croquet set, golf clubs, horseshoes, large playground equipment, ping-pong table, or popular record collection. (8 items. TX 294)

68. Recreational and Educational Equipment--Individualizing Conditions. Ownership by family and frequent use of archery equipment, classical record collection, easel and oil paints, encyclopedia or home reference library, microscope, photographic dark room, power tools, tropical fish aquarium, or typewriter. (9 items. TX 295)

69. Clubs and Organizations--Group Membership. Active member or member for more than one year in such clubs as Boy Scouts, fraternity, science club. (12 items. TX 296)

70. Clubs and Organizations--Group Leadership. Held an office in such clubs as covered by var 69. (12 items. TX 297)

71. Individual, Non-Cooperative Sports Activity. Participated in such individual sports as boxing, bowling, golf. (14 items. TX 298)

72. Sports--Team Sports Activity. Participated in such team sports as baseball, basketball, football. (6 items. TX 299)

73. School Subjects--Science Training. Studied for various semesters in high school: mathematics and science courses. (6 items. TX 300)

74. School Subjects--Industrial Training. Studied for various semesters in high school: mechanical drawing, metal shop, or woodworking. (3 items. TX 301)

75. School Subjects--Commercial Training. Studied for various semesters in high school: arithmetic (business), bookkeeping, economics, or typewriting. (4 items. TX 302)

76. School Subjects--General Humanities. Studied for various semesters in high school: art, social studies, English, history, foreign language, or music. (6 items. TX 303)

77. School Subjects--Military Training. Studied for various semesters in high school: military drill. (1 item. TX 304)

78. School Subjects--Religious Training. Studied for various semesters in high school: Religion. (1 item. TX 305)

79. Entertainment, Crafts, and Hobbies--Teen Age Socialization. Occasionally or frequently engaged in these activities: attending movies, parties, hay rides, roller skating, social dancing, square dancing. (6 items. TX 306)

80. Entertainment, Crafts, and Hobbies--Literary or Artistic Withdrawal. Frequently or most of spare time engaged in these activities: drawing or painting, reading essays or poetry, reading novels or fiction, writing short stories or articles, writing poetry or essays. (6 items. TX 307)

81. Entertainment, Crafts, and Hobbies--Musical Interest. Frequently or most of spare time engaged in these activities: attending concerts, composing music, playing a banjo or guitar, playing instrument in an orchestra or band, playing the piano, singing. (6 items. TX 308)

82. Entertainment, Crafts, and Hobbies--Hobby Withdrawal. Frequently or most of spare time engaged in these activities: building model airplanes, building model ships, building model trains or cars, woodworking, working with metal. (5 items. TX 309)

83. Entertainment, Crafts, and Hobbies--Breadth of Social Skills. Participating once or twice, or occasionally, in the activities covered in vars 79-82. (30 items. TX 310)

84. Tools and Implements--Farm Background. Used often and was fairly skilled with, or used often and highly skilled with: combine, corn knife, harrow, hay mower, milking machine, pitchfork, plow. (7 items. TX 311)

85. Tools and Implements--Mechanical Construction Activity. Used fairly often but was not particularly skilled with; used often and was fairly skilled with; or used often and was highly skilled with, such mechanical aids as a bench saw, drill brace and bit, drill press, etc. (13 items. TX 312)

86. Tools and Implements--Use of Weapons. Used often and was fairly skilled with; or used often and highly skilled with: pistol, rifle, shotgun. (3 items. TX 313)

APPENDIX B

DESCRIPTION OF REFERENCE AND EXPERIMENTAL APTITUDE MEASURES

Reference Measures

Army Classification Battery Tests (ACB) (Variables 7 - 12)

The General Technical Aptitude Area (GT), used in selecting trainees for the course, is an equally weighted composite of two ACB test scores, Reading and Vocabulary (var 9) and Arithmetic Reasoning (var 10).

Psychomotor Tests

13. Complex Coordination. The examinee is required to make adjustments of stick and pedal controls in response to successively presented patterns of visual signals. Testing time is eight minutes. Score is number of completed matchings.

14. Rudder Control. The examinee sits in a mock cockpit which his own weight throws off balance unless he applies correction by means of foot pedals. His task is to keep the cockpit lined up with one of three target lights. Testing time is one 90-second center target trial and one 348-second triple target trial. Score is total time on target.

15. Rotary Pursuit. The examinee is required to keep a stylus in contact with a small metallic surface set into a rapidly revolving disk. Testing time is three trials of 20-seconds each. Score is total time on target.

Personality Measures

16. Officer Candidate Evaluation Report, (DA PRT 649). Form by means of which the performance of the applicant for helicopter training is evaluated with respect to his leadership performance potential. This report is made out by the immediate supervisory NCO and endorsed by the immediate superior commissioned officer.

17. Officer Candidate Interview (PRT 650). The applicant is presented informally with problem situations for discussion with an Officer Candidate Interview Board composed of five officers. The manner in which the applicant handles each problem gives the Board an opportunity to observe and evaluate him in terms of such specifics as self-assurance, appearance, voice control, and ability to organize ideas. Board members make independent evaluations of the applicant. These evaluations are later combined into a numerical index. In the second half of the

examining board procedures, the applicant is appraised on the basis of his complete record to determine his overall qualifications for a Warrant. The Board then submits to the major commander recommendation to reject or accept the applicant. The numerical index of those applicants who received Board acceptance and who were later accepted into training was the OCI measure assessed in this study.

18. Interim Operational Battery. The score on this battery was used in selecting applicants for training. It was obtained by averaging one-half the OCE score and the OCI score. This formulation gave approximately equal weights to each of the scores in the composite.

19. Background Inventory, (DA PT 3035). The 30 five-choice items of this inventory relate to the examinee's family, education, hobbies, and employment. Score is number right.

Experimental Aptitude Measures

20. Aiming (DA PRT 3074). The examinee is required to make one dot in each of many circles, 1/8 inch in diameter, working as fast and accurately as possible. Testing time is 50 seconds. Score is number of circles dotted correctly (within or on perimeter).

21. Tapping (DA PRT 3072). The examinee is required to make three dots in each of many circles 1/2-inch in diameter working as fast and accurately as possible. Testing time is two minutes. Score is number of circles dotted correctly (within or on perimeter).

22. Patterns (DA PRT 2788). The examinee is required to reproduce on an answer sheet a line pattern which conforms to a pattern presented in a different part of the answer sheet. Testing time is six minutes. Score is number of correct spaces filled.

23. Stick and Rudder Orientation (PT 3175). This 30-item speed test presents the examinee with three photographs taken from the cockpit of a plane doing simple maneuvers (banking, turning, climbing, and diving) or combinations thereof (climbing turns, etc.). The examinee is required to relate these maneuvers to stick and rudder positions printed on the answer sheet. The score is rights minus one-fourth wrongs. Testing time is 10 minutes.

24. Coordinate Movements (PT 3076). This test (also called Complete Movements Test) requires the examinee to judge distances and visualize movements quickly, and to relate these distances and movements to a set of symbols. The score is rights minus one-fourth wrongs. Testing time is 10 minutes.

25. Flying Information (PT 3209). This 70-item test consists of questions about general and technical aviation information. The score is rights minus one-third wrongs. Testing time is 50 minutes.

26. Mechanical Knowledge (MK-1, Navy Test). This test requires the examinee to select one of four pictures of tools which is associated with a fifth picture. The 40 sets of pictures represent tools used in various trades--carpenter, machinist, plumber, etc. Testing time is 10 minutes. Score is rights minus one-third wrongs.

27. Mechanical Ability (DA PT 3118). The first part of the test consists of 30 four-choice items largely relating to automotive equipment and functions. The second part consists of 20 four-choice items requiring the examinee to solve practical mechanical problems. Testing time is 30 minutes. Score is rights minus one-third wrongs.

28. Army Electrical and Radio Information (DA PT 2904). The first part of the test consists of 22 items requiring the examinee to select from four pictures of electrical equipment the one most like--or which belongs with--a fifth picture. The second part consists of 20 four-choice electrical and radio information items. Testing time is 15 minutes. Score is number right.

APPENDIX C

VALIDITY COEFFICIENTS OF REFERENCE AND APTITUDE MEASURES FOR SEVERAL HELICOPTER SCHOOL CRITERION FRACTIONS

Var. No.[a]	Variable	M N = 242	SD N = 242	Pass-Fail Preflight N = 242	Leadership Ranking N = 146	Pass-Fail Flight N = 184	Percent Satisf. Flights N = 184	Final Flight Grade N = 146	Final Acad. Grade N = 14
Army Classification Battery									
7	Reading and Vocab	122.8	11.1	.16	.02	-.22*	-.17*	-.04	.30*
8	Arith Reasoning	115.8	10.4	.06	.04	.13	.01	-.04	.41*
9	Pattern Analysis	119.8	13.5	.30**	.06	.25*	.15*	.07	.22*
10	Mech Aptitude	116.5	14.4	.19*	.14	.13	.16*	.11	.27*
11	Clerical Speed	105.4	15.9	.06	.02	-.13	-.07	-.10	.11
12	Radio Code	108.5	22.3	.08	.04	.05	.04	-.02	.15
Psychomotor Tests									
13	Complex Coord	38.2	8.4	.20*	-.04	.46**	.37**	.38**	.25*
14	Rudder Control	44.7	11.8	.15	-.04	.64**	.41**	.08	.14
15	Rotary Pursuit	16.9	6.4	.14	-.01	.42**	.25**	-.02	.05
Personality Tests									
16	OCE	121.9	16.4	-.03	.28**	-.02	-.05	-.08	.01
17	OCI	30.4	6.3	.24**	-.06	.04	.00	-.11	.07
18	OCE + OCI (Interim Op Battery)	91.5	10.2	.14	.16*	.02	-.03	-.14	.04
19	Background Inventory	10.4	3.0	.29**	.08	.08	.04	.10	.08
Experimental Aptitude Tests									
20	Aiming	110.6	15.6	.22*	-.06	-.09	-.04	-.01	.06
21	Tapping	135.0	20.9	.10	.03	.16	.00	-.11	.16*
22	Patterns	61.8	13.7	.15	.02	.36**	.17**	.09	.29**
23	Stick and Rudder	22.2	9.8	.20*	.10	.28**	.20**	.08	.30**
24	Coord Movements	28.0	9.4	.24**	.12	.20**	.13	.07	.32**
25	Flying Info	22.8	11.5	.05	.05	.09	.06	.01	.29**
26	Mech Knowl	25.9	6.2	.19*	.14	.12	.13	.09	.24**
27	Mech Ability	47.8	11.3	.05	.11	.17	.15*	.12	.35**
28	Elec and Radio Info	33.1	6.3	.08	.02	.00	.00	.04	.38**

[a]Variables are defined in Appendix B.
*Significant at .05 level
**Significant at .01 level

AD Div 23/1, 28/4

Human Factors Research Branch, TAG R and D Command, DA DEVELOPMENT OF EXPERIMENTAL SELECTORS FOR ARMY HELICOPTER PILOT TRAINEES--PERSONALITY CONSTRUCTS by Nathan Rosenberg, Donald M. Skordahl, and Alan A. Anderson. August 1961. Rept on Helicopter a-33 Proj. -- 31 p. incl. tables, 4 Ref. (HFRB Technical Research Note, No. 115)
(DA Project 2L95-60-001) Unclassified Report

As part of a long-range research effort to improve selection of helicopter pilot trainees and to reduce rate of attrition during training, four personality instruments were developed, designed primarily to predict leadership performance in operational units. Data were obtained on 242 helicopter pilot trainees constituting six entering classes of the Army Primary Helicopter School. The effectiveness of 57 construct keys and of one overall judgment key as predictors of helicopter pilot training success was estimated and the validity of the numerous construct keys was assessed against various aspects of pilot training. Of these aspects, successful completion of preflight training and leadership ranking by peers were considered most predictable by the personality measures.

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